PARTICIPATORY SELECTION OF YELLOW, BROWN, SUGAR AND TAN BEAN MARKET CLASSES IN EASTERN CONGO

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Introduction

Yellow, brown and tan bean cultivars are widely consumed and traded in the Great Lakes region of Eastern Africa. These cultivars are often grown and sold as mixtures. The region is known for some of the greatest diversity in bean germplasm. Yellow, brown and tan seed types are rated as highly important in DR Congo, Rwanda, Burundi, Angola, Zambia and parts of Ethiopia, Kenya, Tanzania, Uganda, Sudan, Madagascar and Mozambique. They account for 11% of Africa's bean production. Productivity of these grain types in constrained by diseases especially angular leaf spot, anthracnose, common bacterial blight, root rots and soil fertility stress factors especially acidity, low soil nitrogen and phosphorus. Development of yellow, brown and tan grain types is one of the priorities of the regional bean program. A regional program was started in 2001 to develop yellow, brown and tan bean cultivars with improved tolerance to two or more biotic and abiotic stresses for smallholder farmers in East and Central Africa. Selection for genotypes tolerant to priority production constraints from existing and new breeding populations was conducted collaboratively by INERA (Mulungu, DR Congo) and University of Nairobi (Kabete, Kenya). Eastern Congo is one of the leading producers of yellow, brown and tan grain types. These market classes account for 49.5 % of total bean production in North Kivu, 16.5 % in south Kivu, 10.5% in the Oriental Province and Ituri, and 8.20% in Oriental Kasaï. Eastern Congo is main producing bean area in DR Congo. The common bean is a staple food which provides more than 45% of protein in the diet of the poorer people of the countries comprising Burundi and Rwanda in the Great Lakes region. The breeding program has been focused on participatory development of new improved marketable bean varieties, in partnership with national and international research institutions, farmers and farmer's association, NGOs, private sector and other stakeholders. Participatory selection was adopted to improve identification of marketable lines and adoption.

Materials and Methods

Breeding populations were generated from crosses and backcrosses among parents with resistance to angular leaf spot, bean stem maggot, tolerance to low soil nitrogen, phosphorus and acidity, and locally important susceptible cultivars (Nakaja, Kirundo and Munyu). Additional segregating populations and advanced lines were received from the regional bean breeding program at Kabete, Kenya. Sources of resistance to angular leaf spot included G5686, Mexico 54, Jalo EEp 558, MAR 1 and A235. Resistance to bean stem maggot was contributed by Besh Besh, Acc 714, G 11727 and G 8074. COM 9315-1, G5889 and More 92018 provided tolerance to low soil nitrogen, VEF 88(40) to low soil P. AFR 708, RWR 1873 and LSA 144 were sources of tolerance low soil pH complex. The parents were crossed pairwise in a diallel scheme and the final combination used as male parent in the final cross. The hotspots for these constraints were created to screen the segregating populations derived from the crosses. Lines combining tolerance to two or three stresses and preferred grain type were selected following pedigree procedure in the early generations, followed by participatory evaluation by farmers on-station and on-farm.

Results and Discussion

Twenty-four 24 brown and tan bean market classes, 25 sugars, 28 red mottled and 17 yellow bean market class were finally selected in 2003. The characteristics of some of the lines are shown in Tables 1 and 2. Breeding capability has been strengthened by the local crossing activities which generated additional genetic diversity toward selection purpose. The new lines were coded as CODMLB or CODMLV which stand for Congo Democratic Mulungu Lines, Bush or Climbers as shown in the Tables 1 and 2.

Table 1. Grain type, 100-seed mass, duration to flowering and grain yield of bush bean lines after participatory evaluation over two seasons at Mulungu, DR Congo.

Line	Grain type	100-seed mass (g)	Days to 50% flowering	Days to 95% maturity	Grain yield (kg ha-^{1})		
					2002A	2002B	Mean
SEQ 1006	Red mottled	41.0	49	94	695	1874	1285
M'MAFUTALA (Check1)	Brown	22.8	42	94	850	1697	1274
KIRUNDO (Check 2)	Yellow	37.9	42	87	834	1689	1258
RWK 5	Sugars	17.1	49	90	838	1599	1218
M 1/98	Sugars	37.5	42	94	483	1838	1160
MLB 207/96B	Sugars	18.7	53	94	629	1669	1149
DOR 481	Sugars	24.0	42	94	873	1288	1058
ZKA 94-12M/95	Sugars	33.0	42	84	686	1346	1016
MLB 174/94B	Brown	24.0	42	94	875	1063	969
ZKA 98-6M/95	Brown	21.9	49	94	424	1222	950
MUNYU (Check 3)	Cream	48.0	40	84	470	1417	944
ITURI MATATA		34.5	40	84	379	351	367
GENOTYPES (G)					**	**	
SEASONS (S)					**	**	
G X S					**	**	
MEAN					612	1111	862
L.S.D.$_{05}$					250.7	501.6	392.1
C.V. %					25.0	27.6	28.1

**Significant at 1% probability level.

Table 2. Grain type, 100-seed mass, duration to flowering, maturity and grain yield of climbing bean lines selected after participatory evaluation over two seasons at Mulungu, DR Congo.

VARIETY NAME	Grain type	100-seed mass (g)	Days to 50% flowering	Days to 95% maturity	Grain yield (kg ha-^{1})		
					2002A	2002B	Mean
CODMLV 044	Purple	33.0	47	98	904	2125	1514
CODMLV 045	Brown	35.8	51	98	1002	1686	1344
G 59/1-2 (Check 1)	Brown	39.9	45	98	1014	1445	1229
CODMLV 046	Brown	30.2	51	110	596	1741	1169
CODMLV 047	Brown	35.2	47	98	468	1835	1151
CODMLV 048	Tan	36.0	45	98	468	1709	1083
MLV 135/97B	White	24.5	51	110	840	1321	1081
CODMLV 049	Tan	46.7	45	98	779	1364	1072
MLV 224/97A	Brown	33.7	51	110	542	1422	982
AND 10 (Check 2)	Sugars	33.8	51	110	921	998	959
GENOTYPES (G)					**	**	
SEASONS(S)					**	**	
G X S					NS	NS	
MEAN					628	1386	1007
L.S.D .$_{05}$					286.0	723.3	574.0
C.V. %					27.3	31.3	32.7

**Significant at 1% probability level.

References

Kimani, P. M., R. Chirwa and M. Pyndji. 2001. Bean Breeding Strategy in PABRA countries. Presented at the PABRA Millenium Workshop, June 2001, Arusha, Tanzania.